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Applicant: Seiko Epson Corp.

TITLE: INK JET RECORDER

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to a technical field of an ink jet recorder which can carry out an ink jet printing process.

[0002]

[Prior Art]

An example of conventional ink jet recorders having an ink supply means of this type is disclosed in Japanese Patent Application Laid-Open (JP-A) No. 7-125242 (publicly known example).

[0003]

In summary, this publicly known example discloses an ink jet recorder which records images by moving a recording head, the ink jet recorder comprising: a recording head 1; a first ink tank

(sub-tank 2) included in the recording head 1; ink supply means 8, 9A, 9B and 10 connected to the first ink tank 2 in accordance with a movement of the recording head 1 to its home position; remaining ink amount detecting means 4 provided inside the first ink tank 2; and a fixed second ink tank 12, wherein ink is supplied from the second ink tank 12 to the first ink tank 2 by the ink supply means when the remaining ink amount becomes a predetermined value or less while the recording head 1 is at the home position.

[0004]

[Problems to be Solved by the Invention]

While the publicly known example described above can supply ink, it still requires further improvement.

[0005]

A first object of the present invention is to provide an ink jet recorder which eliminates a remaining ink amount detecting means provided at an ink cartridge.

[0006]

A second object of the present invention is to provide an ink jet recorder which can prevent excessive or insufficient supply of ink to a sub-tank.

[0007]

A third object of the present invention is to provide an ink jet recorder which can easily control the amount of ink to be supplied to the sub-tank.

[0008]

A fourth object of the present invention is to provide an ink jet recorder which can prevent ink from evaporating from the liquid level of the ink in the sub-tank.

[0009]

A fifth object of the present invention is to provide an ink jet recorder which can catch impurities and bubbles of the ink supplied to the sub-tank.

[0010]

A sixth object of the present invention is to provide an ink jet recorder which can stabilize the movement of a float to accurately control supply of the ink to the sub-tank.

[0011]

A seventh object of the present invention is to provide an ink jet recorder which can effectively supply ink to the sub-tank by using a simple means, which is an electric circuit.

[0012]

An eighth object of the present invention is to provide an ink jet recorder which can easily carry out numerical control for the amount of ink to be supplied to the sub-tank.

[0013]

[Means for Solving the Problems]

Means for achieving the above objects are as follows.

[0014]

(1) An ink jet recorder comprising: a recording head including a head portion from which ink is ejected and a sub-tank for supplying the ink to the head portion; a main tank for holding ink to be supplied to the sub-tank; supply means for supplying the ink from the main tank to the sub-tank; calculating means for calculating the amount of ink ejected and discharged from the head portion; and supply control means for controlling the amount of ink to be supplied based on the result of the calculation.

[0015]

(2) An ink jet recorder comprising: a recording head including a head portion from which ink is ejected and a sub-tank for supplying the ink to the head portion, the sub-tank having a float provided on the liquid level of the ink therein and a switch for stopping supply of the ink when the float is brought into contact therewith; a main tank for holding ink to be supplied to the sub-

tank; and supply means for supplying ink from the main tank to the sub-tank.

[0016]

(3) The ink jet recorder according to (1), wherein the sub-tank includes a float provided on the liquid level of the ink therein and a switch for stopping supply of the ink when the float is brought into contact therewith.

[0017]

(4) The ink jet recorder according to (2), wherein a part of the float or the entire float is formed of a conductive material, and the switch is operated when the float is brought into contact therewith, whereby an electric circuit is closed.

[0018]

(5) The ink jet recorder according to (2), wherein the shape of the float is substantially the same as a cross-section of the sub-tank.

[0019]

(6) The ink jet recorder according to (2), wherein at least a portion of the float located near an ink supply position is a filter.

[0020]

(7) The ink jet recorder according to (1), wherein the calculating means calculates the sum of the number of dots ejected and the number of dots corresponding to the amount of ink discharged.

[0021]

(8) The ink jet recorder according to (1), wherein the supply control means controls the number of revolutions of a motor for a pump based on the result of the calculation according to (7).

[0022]

(9) The ink jet recorder according to (1), wherein the supply control means controls such that ink is supplied to the sub-tank in an amount somewhat larger than the result of the calculation obtained by the calculating means.

[0023]

(10) The ink jet recorder according to (2), wherein a movable range of the float within the sub-tank is the smallest to enable the operation of the switch.

[0024]

According to the above means, ink is supplied in a timely manner to the sub-tank in an amount corresponding to the amount of ink consumed, whereby excessive or insufficient supply of ink is

eliminated. Therefore, the present invention can effectively achieve the above objects.

[0025]

[Embodiments]

The present invention will be hereinafter described in detail, based on embodiments thereof illustrated in the drawings. A common structure of the present invention is as follows.

[0026]

#### 1. Means

Namely, an ink jet recorder 100 shown in Fig. 1 includes a recording head 100 which can hold ink therein. The recording head 100 includes a sub-tank 10 and a head portion 20. The sub-tank 10 has a switch 30 by which supply of the ink to the sub-tank 10 is stopped, while the head portion 20 has a supply detecting means 40 for detecting the amount of ink to be ejected and discharged from the head portion 20. A main tank 300 is disposed adjacent to the recording head 100 and supplies ink IK to the sub-tank 10 by a supply means 200 such as a pump driven by a motor or the like. The supply means 200 is structured such that operation thereof is controlled by a supply control means 500, which is operated by an instruction from a calculating means 400. The supply means 200 is also operated by a detection signal from the switch 30.

[0027]

It is preferable that the calculating means 400 has a function of calculating the sum of the number of dots ejected from the head portion 20 and the number of dots corresponding to the amount of ink discharged.

[0028]

## 2. Operation

The present invention will be described below with reference to a first embodiment thereof.

[0029]

(First Embodiment)

## 1. Means

The recording head 100 shown in Fig. 2 is characterized in that it includes a float 11 floating on the liquid level of the ink IK inside the sub-tank 10 and moving up or down along with the liquid level, and in that the switch 30 is disposed at a cover 12 of the sub-tank 10.

[0030]

## 2. Operation

The ink IK inside the sub-tank 10 is supplied from the head portion 20 of the recording head 100 in an appropriate

amount as the ink is consumed by the recording means. A decrease in the amount of the ink in the sub-tank is detected by the supply amount detecting means provided at the head portion 20. Using the detection signal from the supply amount detecting means, the calculating means 400 calculates the sum of the number of dots ejected and the number of dots corresponding to the amount of ink discharged and transmits the result of the calculation to the supply control means 500.

[0031]

The supply control means 500 starts the supply means 200 in accordance with a preset value. For example, when the supply means 200 is a motor-driven pump, the number of revolutions, a revolution period, or the like of the motor is specified for operation. With this structure, the ink IK in the main tank 300 shown in Fig. 1 is smoothly supplied to the sub-tank 10.

[0032]

When the supply means 200 is set in advance so that an amount of the ink IK somewhat larger than the calculation result is supplied to the sub-tank 10, a shortage of the ink IK does not occur in any case, which is preferable.

[0033]

The switch 30 is disposed at the cover 12 of the sub-tank

10 so as to face the float 11. Thus, when the ink IK is supplied to the sub-tank 10 and the float 11 is moved up and abuts the switch 30, the switch 30 is turned off and the signal thereof is transmitted to the supply control means 500, whereby the operation of the supply means 200 is immediately stopped.

[0034]

In this way, an overflow of the ink in the sub-tank 10 is securely prevented. As the ink is continuously consumed and the float 11 is moved down, the switch 30 is turned on, whereby the ink IK can be automatically supplied to the sub-tank 10.

[0035]

(Second Embodiment)

A recording head 100A significantly differs from the recording head shown in Fig. 2 in that the planar shape of a float 11A is substantially the same as the transverse sectional shape of a sub-tank 10A; an electric conductor 14A is attached to the surface of the float 11A; and a switch 30A is disposed at a cover 12A so as to face the electric conductor 14A.

[0036]

Thus, when the ink IK in the sub-tank 10A is increased and the float 11A is moved up and abuts the switch 30A, the switch 30A is turned off to stop the supply means 200.

[0037]

The second embodiment is similar to the first embodiment in other aspects.

[0038]

The float 11A only needs to turn off the switch 30A. Thus, it suffices if at least a part of the float 11A is formed of a conductive material.

[0039]

(Third Embodiment)

A portion of a float 11B disposed inside a sub-tank 10B of a recording head 100B shown in Fig. 4 is permeable so as to serve as a filter 15B. The filter 15B is preferably disposed so as to be near and facing an ink supply port 16B provided at a cover 12B.

[0040]

Therefore, when the ink IK is supplied to the sub-tank 10B, impurities and bubbles of the ink IK can be effectively removed.

[0041]

Since the third embodiment is similar to the first or second embodiment in other aspects, the same reference numerals are used to indicate the components except that "B" is attached at the

end.

[0042]

(Fourth Embodiment)

A movable portion 17C for a float 11C is provided at a sub-tank 10C of a recording head 100C shown in Fig. 5. The float 11C moved up or down by the ink IK is formed so as to be movable only within the movable portion 17C.

[0043]

With this structure, the float 11C is moved in a stable manner, and a signal indicating an instruction on supply of the ink IK can be accurately transmitted. In this way, the ink IK inside the sub-tank 11C can be securely prevented from overflowing.

[0044]

Since the fourth embodiment is similar to the first or second embodiment in other aspects, the same reference numerals are used to indicate the components except that "C" is attached at the end.

[0045]

[Effects of the Invention]

The present invention described above has the following significant effects corresponding to claims thereof.

[0046]

1. The amount of ink ejected and discharged from the sub-tank can be easily controlled, thereby eliminating the need for the ink remaining amount detecting means. (Claim 1)

[0047]

2. Excessive supply of the ink to the sub-tank can be prevented. (Claim 2)

[0048]

3. Supply of the ink to the sub-tank can be controlled. (Claim 3)

[0049]

4. The aforementioned effect 2 can be obtained by a simple means, which is an electric circuit. (Claim 4)

[0050]

5. The ink inside the sub-tank can be prevented from evaporating from the liquid level thereof. (Claim 5)

[0051]

6. Impurities and bubbles of the ink supplied to the sub-tank can be caught and removed. (Claim 6)

[0052]

7. Numerical control for the amount of the ink supplied to the sub-tank can be easily carried out. (Claim 7)

[0053]

8. The amount of the ink supplied to the sub-tank can be easily controlled. (Claim 8)

[0054]

9. Insufficient supply of the ink to the sub-tank can be prevented. (Claim 9)

[0055]

10. The movement of the float inside the sub-tank can be stabilized. (Claim 10)

#### [BRIEF DESCRIPTION OF THE DRAWINGS]

[Fig. 1]

Fig. 1 is a schematic view of an ink jet recorder according to an embodiment.

[Fig. 2]

Fig. 2 is a schematic view of a recording head according to a first embodiment.

[Fig. 3]

Fig. 3 is a schematic view of a recording head according to a second embodiment.

[Fig. 4]

Fig. 4 is a schematic view of a recording head according to a third embodiment.

[Fig. 5]

Fig. 5 is a schematic view of a recording head according to a fourth embodiment.

[Description of the Reference Numerals]

1000: ink jet recorder  
100 (A to C): recording heads  
10 (A to C): sub-tanks  
11 (A to C): floats  
12 (A to C): covers  
14A: electric conductor  
15B: filter  
17C: movable portion  
20 (A to C): head portions  
30 (A to C): switches  
40: supply amount detecting means  
200: supply means  
300: main tank  
400: calculating means  
500: supply control means

[DOCUMENT NAME]      ABSTRACT OF THE DISCLOSURE

[SUMMARY]

[OBJECT]

To provide an ink jet recorder capable of supplying ink in a timely manner corresponding to consumption of ink in a sub-tank by eliminating excess and deficiency of the ink.

[MEANS FOR SOLUTION]

This ink jet recorder comprises a recording head 100 having a sub-tank 10 for holding ink provided in the head portion 100, a main tank 300 for supplying ink to the sub-tank 10, a supply means for supplying the ink from the main tank 300 to the sub-tank 10, a calculating means 400 for calculating an amount of the ink which is ejected or discharged from the head portion 100 and a supply control means 500 for controlling the supply amount of the ink in accordance with the calculated result. The sub-tank 10 includes a float provided on a liquid level therein and a switch 30 for stopping the supply of the ink when the float is brought into contact with the switch 30. A part of the whole of the float is made of a conductive material and the shape of the float is roughly the same as the shape of the cross-section of the sub-tank 10. At least a part of the float is made to be like a filter.

FIG. 1

40: SUPPLY AMOUNT DETECTING MEANS

400: CALCULATING MEANS

500: SUPPLY CONTROL MEANS